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Archaeoastronomy of the Temples of the Bekaa Valley

Giulio Magli

Department of Mathematics, Politecnico di Milano, 20133 Milan, Italy; Giulio.Magli@polimi.it

Abstract: The Bekaa Valley, Lebanon, is famous worldwide due to the magnificent temple of Heliopolitan Jupiter at Baalbek. In recent years, new research revived the interest in the unsolved problems posed by the Baalbek monuments, including original dating and construction phases, relationships with the landscape, and nature of the cult practiced. In a preliminary paper, we used archaeoastronomy to propose that the project of the Temple of Jupiter was a unified one conceived under Herod the Great, and that the cult was strongly connected to the renewal of the seasonal cycles. Here, we extend and confirm this analysis considering the other temples of the Baalbek proper and the three prominent sanctuaries which lie in the Bekaa Valley on the way to Baalbek from Berytus, showing the existence of an orientation custom which appears to originate in Baalbek and to inform all these sacred places.

Keywords: archaeoastronomy; Temple of Jupiter Heliopolitanus; Roman temples of Lebanon

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1. Introduction

The Bekaa valley (Figure 1) develops for some 120 Km between Mount Lebanon to the west and the Anti-Lebanon chain to the east. At the end of the Seleucid Kingdom, the area fell into the hands of a local dynasty, the Iturean tetrarchs of Chalkis. The Roman influence in the area started with Pompey, but the tetrarchs remained in charge up to the end of the first century AD, when the foundation of a Roman colony in Berytus, the future Beirut, occurred (14 BC). It is difficult to ascertain with accuracy the exact boundaries of the colony, but there is no doubt that the valley was since then under Roman control, either directly or through the local colonial administration [1].

Between the end of the first century BC and the mid-second century AD, the valley became, for unknown reasons, a very important sacred place where huge temples and sanctuaries were constructed. Among them, by far the most important is the Temple of Jupiter Heliopolitanus, located in Baalbek at a very ideal centre of the valley. This temple is the is the core of a complex which included at least four other temples: the so-called Temples of Bacchus, of the Muses, of Venus, and a (today destroyed) Temple of Mercury. Other important, connected monuments we consider in this work are the sanctuaries/temples located in the valley along the approach to Baalbek: Niha, Hosn Niha, and Qsarnaba. This is the first systematic study on the archaeoastronomy of the Roman Temples in the Bekaa valley, while Roman urban settlements [2,3] and Nabatean tombs and settlements [4] have been studied.

All the temples of the Bekaa Valley pose problems regarding dating, attribution, and interpretation, and even the true nature of the cult of Jupiter is still debated (for a recent overview of the Archaeology of the Bekaa Valley, see [1]). The aim of the present paper is to apply the approach of modern archaeoastronomy to investigate these and related issues. In this approach, orientations are studied in context, with the objective of gaining information on the cult practiced and the chronology of the temples. Our main results are:

(1) The cult of Jupiter Heliopolitanus had an "agrarian" character related to renewal and harvesting, contrary to the sometimes claimed "solar" connotations, which instead turn out to be a possible association with the cult practiced in the so-called Temple of the Muses.
(2) The cult spread in the valley in the first half of the second century. The attribution of the large temples constructed in pre-existing sanctuaries (which is as yet unsure) is shown to be tightly related to that of the main temple as all these buildings belong to a common orientation family.

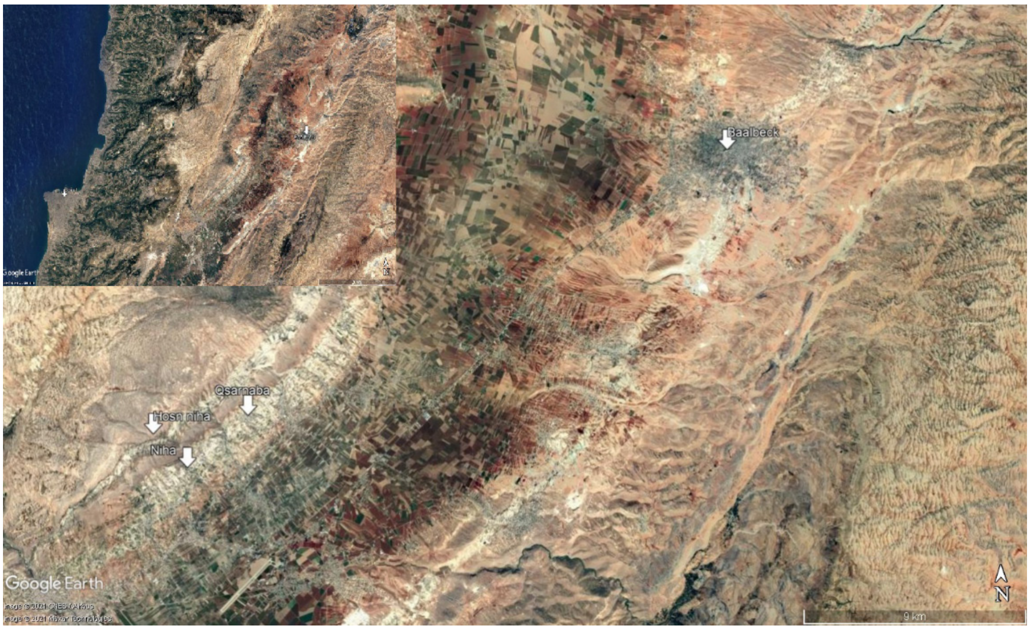


Figure 1. Positioning of the Bekaa Valley with respect to the Lebanese capital Beirut (upper left) and the main sites mentioned in the text (Image courtesy of Google Earth, editing by the author).

2. The Temples of the Bekaa Valley

In the present section we give a brief description of the monuments studied in this paper, namely the Temple of Jupiter and the so-called Temples of Bacchus, of the Muses, and of Venus in Baalbek (Figure 2) and the sanctuaries of Niha, Hosn Niha, and Qsarnaba in the Bekaa valley.

2.1. The Temple of Jupiter at Baalbek

The Temple of Jupiter Heliopolitanus was the largest constructed in Roman times, with a podium comparable in dimensions only with Hadrian's Temple of Venus and Rome in the Roman forum, which however is a double temple [5]. The complex develops along a monumental axis comprising a hexagonal court and Propilea, both built in the second century AD. The temple proper, which is the most ancient part, measures 48 by 90 m. It stood up to 48 m high, and its columns, resting directly on the edges of the basement, were 20 m high. The basement of the temple is sometimes called—adopting the terminology of Kropp and Lohmann [6]—Podium I, and the structure we describe here is consequently called Podium II. Contrary to my previous works on the subject [7], I came to the conclusion that this terminology is misleading and should not be used. Therefore, here the temple basement is appropriately referred to as a podium, while the other structure is likewise called an external wall (Figure 3).



Figure 2. The temples of Baalbek (Image courtesy of Google Earth, editing by the author).



Figure 3. The southeast side of the Temple of Jupiter. In the foreground, the huge blocks of the external wall, almost identical in shape and size to those of the Western tunnel in Jerusalem. The podium, with squared masonry, is also very similar to Herodian walls on the Temple Mount (photograph by the author).

The external wall runs at a distance of a few meters from the podium and is strictly parallel to it, surrounding the three sides and thus forming a giant U-shaped structure. This wall was built using the superposition of increasingly large stones as the height increases. These stones are used at the basis, larger stones are present in the second course, and huge megaliths (about 500 tons each) were used to build the third course. Finally, immense blocks—around 4 × 4 × 20 m, not less than 800 tons each—were to be placed in the uppermost course; only the southwest side was however completed, putting in place the three famous stones which are usually called (somewhat inappropriately) the "trilithon". At least three other enormous blocks remain in the quarry some hundreds of meters to the southwest [8].

Dating of the temple is very controversial, and, in view of the relevance of the monument in the history of Roman architecture, quite important. The unique aspect which appears to be relatively sure is that the erection of the columns was almost completed in the year 60 AD, as a graffito left by stonemasons has been found on one of the column's summits suggesting this date [1]. Thus, the final phase of construction—with the erection of the enormous columns' drums—belongs to the Julio-Claudian period. Consequently, the most accepted archaeological viewpoint was that the whole building is Julio-Claudian. However, the pre-existence of a Hellenistic sanctuary would seem likely, and a recent architectural analysis of the podium has shown striking similarities to Herodian sanctuaries, such as the use of alternating rows of headers and stretchers and the presence of drafted-margin masonry. In particular, obvious similarities to the Herodian walls at the Temple Mount at Jerusalem exist, not only in general appearance, but also in proportions and measures. All in all, it is natural to conclude that the podium was originally built by Herodian architects [6]. According to the same authors, the external wall postdates the Herodian phase and was designed to "harmonise" the dimensions to Roman standards. However, as I have recently pointed out [7], there also exist clamorous analogies with Herodian buildings for the external wall, in particular between the intermediate course of megaliths and the one located in the western tunnel in Jerusalem; furthermore, the "style" of the immense trilithon's blocks also demonstrates a clear parallel in the Temple Mount walls, for instance in Barclay's gate: In both cases the size of the blocks is similar, and the method of shaping the blocks is also similar. Admitting that the external wall and the podium were built together would also explain their otherwise inexplicable lack of structural connection (the alleged Roman enlargement would have been much easier to obtain by adding masonry to the existing basement) with the intention of building a covered-gallery ambulacrum in the original project. This might be related to oracular activities which were held at the temple, as recorded by Macrobius (Saturnalia I.23.14–16) who states that the Jupiter of Heliopolis announced a bad omen about Trajan's expedition in the Parthian Empire. Finally, it would also explain the identical orientation of the two structures (see Section 4).

As far as the proposal of Herod's intervention is concerned, it should be recalled that Baalbek was under Roman rule and not enclosed in Herod's reign. Since the dismantling of the Iturean control of the area by the Romans, however, we know from several reports that Herod the Great, the vassal King of neighbouring Judea, showed keen attention to the Roman possessions, contributing to relevant architectural projects in various towns including Berytus and Samaria (renamed by him to Sebaste in honour of Augustus).

Other interesting problems occur when we come to analyse the god worshipped in the temple, a question of course related to the chronology as well. The god was called Jupiter Optimus Maximus Heliopolitanus (his name is attested in many sources) and was therefore a form of the Roman Jupiter. However, his iconography—known from cult statues and reliefs and described in the unique written texts we have about Baalbek, with Porphyry's description reported by Macrobius in the fourth century AD—is very far from that of "standard" Jupiter [9,10]. The Heliopolitan God is young and beardless, with a vase-shaped hair volume (Figure 4). Decorations of it vary, but most common are grain ears, although eagles, sun discs, and others also occur. The attributes are a whip in the raised right hand

and again grain ears in the lowered left hand. The god is accompanied by two walking bulls facing the same direction and always wears a sort of tight-fitting robe which exabits complex, and multi-variated, decorations, although the front side usually has Helios and Selene in the top register, and a lion head or lion head mask is often depicted at the bottom.

The origin of this curious iconography has been sometimes attributed to tribal, pre-Roman deities, but there is no known pre-Roman image of this kind, although "standard" Zeus is documented in Iturean coins [9]. Another traditional interpretation is in terms of a solar deity, but besides the mysterious toponym "Heliopolis" attributed to Baalbek (the original Heliopolis of course was the main centre of the cult of the sun god Ra in ancient Egypt), we do not have any proof whatsoever of such a solar character. To complicate matters, research has been delayed for years by the idea that a triad of gods—Jupiter, Venus and Mercury—was actually worshipped in Baalbek trough a syncretism with local deities (Jupiter with Hadad, an ancient Mesopotamian God of Thunder, and Venus with Atargatis, a marine deity). Only recently has this idea of a "Heliopolitan Triad" been shown to lack solid evidence [8].



Figure 4. A bronze statuette of Jupiter Heliopolitanus (image in the public domain/Wikimedia Commons).

2.2. The Other Baalbek Temples

Parallel and extremely close to the Temple of Jupiter stands the so-called Temple of Bacchus, another masterpiece of Roman architecture. It is slightly larger than the Parthenon, with a similar external colonnade. The high staircase with an adyton appears instead to be of local character and is replicated in other sanctuaries. Its attribution to Bacchus is based on the interpretation of some of its reliefs and is purely hypothetical. Other decorations seem to refer to Mercury (but this would give two temples to this deity in Baalbek) yet others to Venus, not to mention that it may be a second temple dedicated to Jupiter Heliopolitanus. Its date of construction should be around the first half/middle of the second century [1].

Close to the entrance of the Jupiter complex, a terraced area contains two further temples [11,12]. The most ancient of the two, today in ruins, is the so-called Temple of the Muses. The suggested date for this building is the end of the first century BC which would make it the very first known Baalbek temple. The Temple was pseudoperipteral, with Corinthian columns inserted in the walls of the cella, following a style present in Italy and Gaul. Curiously, the temple was built in a depression and was—at least according to its excavators—regularly flooded up to the summit of the podium, at least until the construction of an enclosure retaining wall occurred in the second half of the second century. The axis of the Temple is not parallel to that of the later Temple of Jupiter (see next section). Attribution of this temple is indirect and very doubtful (it relies only upon an inscription which prizes a citizen for financing a drainage channel to protect the "Temple of the Muses"; however, the inscription is located on the neighbouring Temple of Venus, which—to mention only one of the problems—is also not securely attributed).

The Temple of Venus is a prostyle round Temple built on the same temenos enclosure of the much earlier Temple of the Muses. It was built on a sort of double podium, but it had problems of construction and was perhaps never finished. Attribution to Venus is very poorly grounded (some external niches are decorated with seashells). It is clearly a late building, perhaps even of the third century AD.

Finally, it is certain that another temple, probably dedicated to Mercury, was located on a hill called Sheikh Abdallah to the southeast of the Jupiter temple entrance [13]. Nothing remains of this structure, however, besides a part of a monumental stairway 13 m wide which ended in a propylon to the temple enclosure.

2.3. The Three Sanctuaries to the South of Baalbek

Some 25–30 Km southwest of Baalbek lie three monumental sanctuaries: Niha, Hosn Niha, and Qsarnaba [14,15]. They are not located directly in the valley but rather on its western side. Niha and Hosn Niha appear to have been originally connected with existing springs; all three are sumptuous buildings, the style and architecture bearing many similarities to the much more famous Baalbek Temple of Bacchus. The Niha complex comprises two temples and a sort of altar platform located close to the point in which the axes of the two Temples cross. Perennial springs are present nearby, and a river flows between the two. The platform should pre-date the temples, of which the smaller (temple B) is a tetrastyle prostyle 12 $\times$ 27.5 m, built on a levelled terrace. The so-called Great Temple or Temple A is built on a podium. It is a huge tetrastyle prostyle, 18 by 41 m, with an adyton shrine. The date of construction of both temples is unsure, but Temple B should pre-date Temple A, with the latter built in the first half of the second century AD. The iconography present in the temple (on lintels, walls and altars) is of difficult interpretation. For instance, a relief shows a man, probably a priest, flanked by two victories and holding cult objects, perhaps a branch or an ear of corn. In another relief, three figures, including a priest, attend at a libation or sacrifice. Uniquely, the style clearly recalls the iconography associated with Jupiter Heliopolitanus, showing close ties with Baalbek. As far as the specific dedication of the temples is concerned, attribution is unknown, but there exist hints that the worshipped deities were Hadaranes and Atargatis. In particular, a votive cippus and a limestone stela have been found, bringing inscriptions honouring a priestess

of these two deities. Interestingly, on the cippus Hadaranes is represented with a style, which again directly recalls Jupiter's iconography.

The complex of Hosn Niha lies close to Niha to the northeast. The sanctuary is located on a terrace levelled with the help of retaining walls. As in Niha, the focus of attraction is a "great" temple (temple A), probably built in the early second century in a pre-existing sacred area which already included a sacred spring and a "small" temple. The small temple is squared, in antis, with pronaos and cella. The great temple is a tetrastyle prostyle with Corinthian columns, pronaos, and cella. The temple (dimensions about 14 × 28 mts) lies on a podium and is accessed through a large, monumental staircase. Huge stones were used for the walls of the cella. All in all, this temple also shares many similarities with the so-called Temple of Bacchus at Baalbek and thus with Niha. Some 200 m to the southwest, the remains of a further building (called the double sanctuary) can be seen. The sanctuary consists of two rooms, both with a single entrance that faces towards the main sanctuary. In front of the entrance to the northernmost room are the remains of two altars, each consisting of a large, squared stone block and an associated top block. Attribution of the Hosn Niha complex is doubtful, but there exists the possibility of a pair of deities, possible a divine couple with a deity and consort. As such this raises the possibility that this is another temple dedicated to Hadaranes and Atargatis, the deities perhaps worshipped at Niha.

The Temple of Qsarnaba is located some 3.2 km northeast of Niha. The temple, similar to the Great Temple of Niha, is built on a high platform and is reached by a high flight of steps. The structure is collapsed but originally was a hexastyle prostyle, comprising a pronaos and a cella with an underground crypt. It is difficult to ascertain if other buildings were present, due to modern constructions.

3. Orientations of the Temples of the Bekaa Valley

Archaeoastronomy has advanced since the times of the mere and somewhat naive studies or uncontextualised alignments and can be considered today as a complete, interdisciplinary science tightly connected to cognitive archaeology [16]. Most archaeologists have started to value this discipline for its cognitive character. One key example, which is relevant in our context, is that of the Greek temples. From a general—and vague—notion that "most Greek temples face the rising sun", studies have turned to analysing specific orientations to connect them to specific deities, sacred attributes, and rites [17–22]. It is our aim here to approach the problem of the archaeoastronomy in the Bekaa valley exactly in the same way, so that—for instance—vague statements such those present in many publications on Baalbek where it is noticed that the Temple of Jupiter "opens to the east" as alleged proof of the solar character of the deity can be overcome by a rigorous analysis.

To study orientations, we use here satellite imagery (Google Earth) which usually allows the determination of both the azimuth and the horizon height (here defined as viewed from the inside looking out) with good approximation. For the present paper, considering that the satellite mapping of the area out of Baalbek proper is not at the maximal possible definition, it is safe to assume an accuracy of ±1 degree. To study the sky at the times of construction, we used the program Starry Night Pro. A complete list of orientations is given in Table 1, where declinations are also calculated using the program GETDEC (kindly provided by Clive Ruggles) which takes into account refraction. To simplify reading of the data, a diagram of orientation is given in Figure 5.

Table 1. Orientations of the temples of the Bekaa Valley.

Place	Date	Temple	Azimuth	Horizon Height	Declination	Notes
Baalbek	Approx. 10 BC (Herodian phase) 50 AD (Julio-Claudian phase)	Jupiter	75°30′	5°	14°40′	
Baalbek	Mid-second century AD	Bacchus	75°30′	4°30′	14°20′	
Baalbek	Third century AD	Venus	320°			towards Temple of Jupiter
Baalbek	Second half of the first century BC	Muses	63°	3°40′	24°	summer solstice sunrise
Baalbek		Mercury				not measurable
Niha	Mid-second century AD	A	74°	5°	16°	
Niha	First century AD	B	156°	2°	−47°46′	
Hosh Niha	Mid-second century AD	A	76°	3°50′	13°34′	
Hosh Niha	First century AD	B	156°	7°30′	−42°40′	
Hosh Niha	First century AD	Double Sanctuary	67°30′	0°	18°10′	orthogonal to temple B; lunar geocentric dec. 18°42′
Qsarnaba	Mid-second century AD		76°30′	2°	12°30′	
Qasr el Banat			75°	1°	12°45′	

The orientation of the Temple of Jupiter already poses interesting questions. The azimuth is of 75°30′ which, taking into account the horizon height, gives a declination ~14°44′. This declination is within the solar range but of course does not correspond either to equinoxes or to the summer solstice; the sun rises in alignment with the temple in early May/mid-August (Gregorian, but the difference with the Julian in the first/second century AD was negligible). These dates are not of special significance for the solar cycle, as a confirmation of the mentioned doubts on a "solar" Jupiter. The dates are not notably close to days of special significance in the Roman calendar either.

A topographical alignment with the area at which the Hellenistic water pipe enters the city, Ain Juj, has been proposed [23]. At Ain Juj the remains of a small round building, with suggested date at the end of 1 BC, were found, but the building is today lost, and its location is unsure. Furthermore, the idea that the largest Temple of the Roman empire was oriented to a water supply, however sacred its source might have been, is frankly difficult to believe (the assertion that the so-called Temple of the Muses is also directed to the same point is only approximatively true; the orientation of this temple is instead clearly astronomical, as shown below). The possibility thus remains that the intended alignment was stellar, and indeed a quite important celestial object was rising in alignment with the temple: the Pleiades. Of course, the Pleiades is an asterism, not a single star (seven stars can be distinguished with the naked eye); however, they can be considered (and were considered in antiquity) as a single entity. They occupy a portion of the sky which spans about ~1/2° in declination. Their declination in Herodian times was between 15°30′ and 16°, slowly increasing with time. The agreement with the temple declination is therefore good, and the horizon height which corresponds to the temple front assures that the asterism was visible. Is this orientation in accordance with what we know about the Heliopolitan Jupiter?

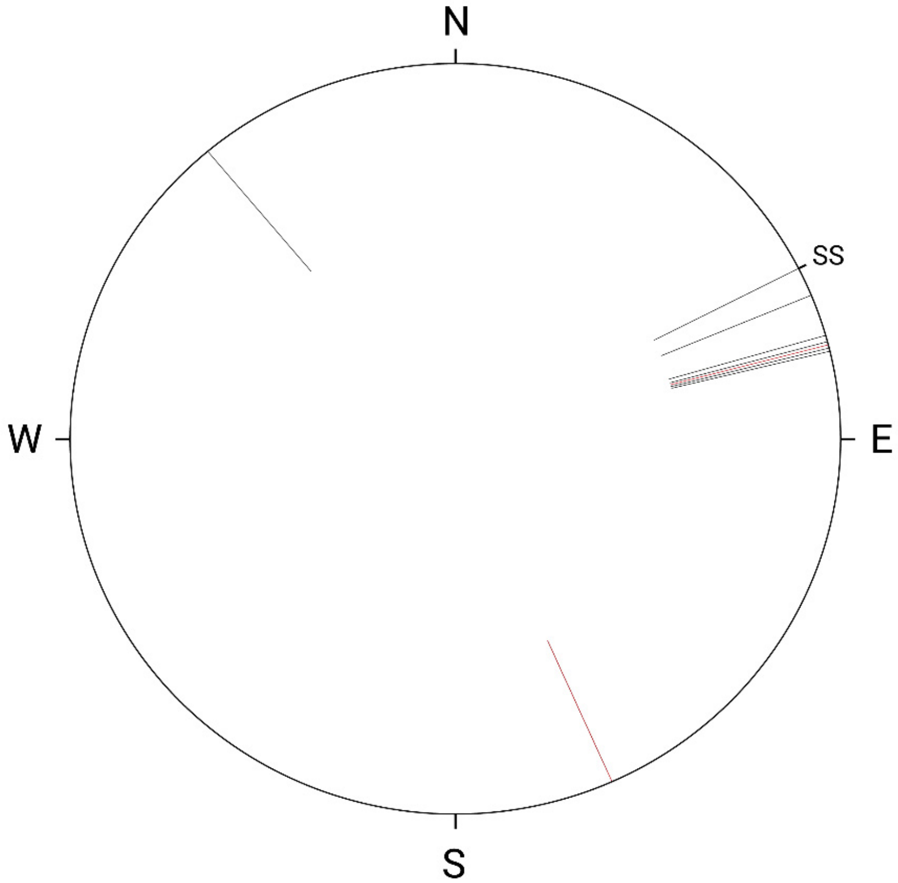


Figure 5. Diagram of orientation of the temples of the Bekaa Valley.

Interest in the Pleiades is well documented in the Greek religion; for instance, the role of this asterism has been shown to be fundamental for the rites of the Artemis Orthia sanctuary in Sparta [17]. This asterism was associated—already in the Hesiod calendar, 8th century BC—with the harvest time of the cereals, indicated by their heliacal rising in the first week of May. This is also the period in which the phenomenon occurred in Baalbek at the end of the first century BC. Therefore, the alignment of the temple individuated both the direction of the heliacal rising of the Pleiades and that of sun at rising, a few minutes later, on the same days, a quite peculiar coincidence. All in all, the alignment of the temple actually points to "agrarian" iconographical associations of Heliopolitan Jupiter, and in particular to renewal and harvesting. The "solar" character of Jupiter Heliopolitanus is therefore indirect; in some way it brings to mind some peculiarities of the cult of Mithra. Many details of Mithraic mysteries are unknown and subject to debate, but the "friendship" of the god with Helios is represented in Mithraic iconography as well as in Jupiter's, and the Mithraic sacrifice of the bull, the central scene of any mithraeum, is certainly connected to renewal and harvesting, as ears of wheat are seen coming out from the bull's tail or wound [24]. The possible existence of a cult for a "true", different solar deity in Baalbek remains due to the orientation of the so-called Temple of the Muses, the attribution of which is unclear. With a declination of ~24°, the temple is indeed clearly oriented to the rising of the Sun at summer solstice.

If we now extend the analysis to the other sanctuaries of the valley, we can notice that a very peculiar situation occurs. Indeed, the original Temples of Niha and Hosn Niha, probably devoted to the cult of waters, were oriented in an identical manner—towards the southeast and the valley. It is interesting to note that, either by chance or by design, their orthogonal direction points to the Moon rising at the minor lunar standstill, and this is also the declination of the double sanctuary at Hosn Niha. Be that as it may, when it was decided to build in both centres of the cult a new, massive temple in the style of the Temple of Bacchus in Baalbek, the old orientation was changed, and the new orientation was also shared by the third temple constructed along the same architectural lines, Qsarnaba. The Temples of Niha A, Hosn Niha A and Qsarnaba indeed all belong to a very limited range of azimuths (74° to 76°30′) and declinations (12°30′ to 16°) which includes the values for Jupiter and Bacchus as well (what appear to be the remains of a further temple in the same style located at Qasr el Banat are also measurable and give similar results). Of course, the sample of data is too small to perform a meaningful statistical analysis, but the fact that three out of three of the temples built in the Valley in the same period and with similar architectural characteristics of the Temple of Bacchus all share a very similar orientation, and that this orientation is the same of the pre-existing main sanctuary in Baalbeck, is a very clear hint (if not proof) of their Heliopolitan character.

4. Discussion and Conclusions

As in recent approaches to the orientation of the Greek temples, we have shown here that the astronomical symbolism incorporated in the temple architecture can give information on the god or cult to which the temple was dedicated. In particular, Heliopolitan Jupiter, with his association to renewal and harvesting, also appears to have been associated with the sun rising in May and the reappearance of the Pleiades. Both the podium and the external U-shaped wall were built respecting closely this orientation, and this is a further hint to a unitarity of the project in Herodian times, since stellar alignments change due to precession, and on the occasion of the alleged second-phase enlargement we would also expect a change in the corresponding alignment.

The comparison of this alignment with those of all other related temples leads to several interesting results. First of all, while there is no proof of a "solar" character sometimes attributed to Jupiter Heliopolitanus, a temple clearly oriented to the sun rising at the summer solstice does exist in Baalbeck: the so-called Temple of the Muses, which is also the oldest. This is a hint to a solar deity worshipped there.

Another result obtained here is the fact that the orientation of the main temple turns out to be shared by the so-called Bacchus temple and by the temples constructed in the valley in the same style. They form a family of monuments, the attribution of which is unsure, but their shared orientation is a strong hint to their tight dependence on the main cult.

All in all, and notwithstanding the mentioned difficulties and the lack of details about the evolution of the cults practiced in the valley, archaeoastronomy can be used to contribute to a tentative and incomplete "cognitive" chronology of the Roman temples of the Bekaa valley as follows:

(1) In pre-Roman or early Roman times, the so-called Temple of the Muses of Baalbek was a place of worship of a deity that very probably had solar connotations due to its orientation at summer solstice sunrise.
(2) During Herod's time, that is under early Roman rule, something happened that made Baalbek the cultic centre of quite an original "version" of Jupiter which had agrarian characteristics associated with renewal and fertility.
(3) Herod's architects started the project of a huge temple. The temple is oriented to the rising of the Pleiades in early May, a phenomenon associated with harvesting since Hesiod's times. The platform of the temple should boast a U-shaped (covered) ambulacrum which was projected in a way very similar to the walls today visible in the Western Tunnel and Barclays Gate of the Temple Mount in Jerusalem, using

immense blocks. The podium and what today appears as an external wall clearly share the same orientation.

(4) In Julio-Claudian times the columns were erected and other works were made, but the megalithic project of the ambulacrum was left unfinished.

(5) Around the mid-second century AD (probably under Antoninus Pius), the so-called Temple of Bacchus was built. The temple is very close to the Temple of Jupiter and strictly parallel to it; the mentioned difficulties in establishing a secure attribution may arise simply from the fact that it was dedicated to Jupiter as well.

(6) The cult spread in the already existing sanctuaries in the valley, which were originally devoted to the cult of waters. As a consequence of this spread, the great Temples of Niha A, Hosn Niha A and Qsarnaba were built with "Heliopolitan" characteristics similar to those of the Temple of Bacchus. In particular, the orientations of these temples adhere to the Heliopolitan model and are radically different from those of the pre-existing buildings (like the Niha Temple B) at the same places.

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